

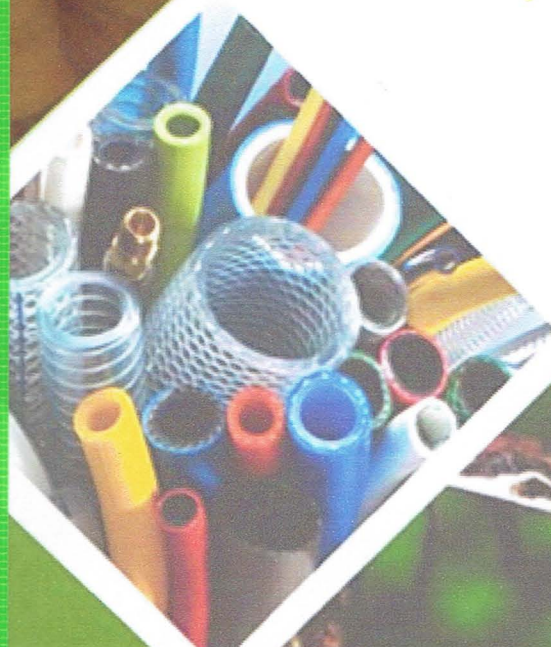


NR Trade Show &  
International Seminars



สถาบันวิทยาศาสตร์  
มหาวิทยาลัยเทคโนโลยีพระจอมเกล้าธนบุรี

# Natural Rubber Trade Show & International Seminars



3<sup>rd</sup> - 5<sup>th</sup> May 2018

Siam Thani Hotel, Surat Thani, Thailand





## Content

Welcome Address	2
-----------------	---

## Invited Speaker

I	<b>Global Economic Outlook and Its Impact on Rubber Prices</b> <i>Mr. Dar Wong</i>	4
II	<b>Outlook on Global Supply and Demand for Natural Rubber</b> <i>Mr. Jom Jacob</i>	5
III	<b>Smart (Fast - Cheap - Quality) Wood Drying : From Basic Science to Industrial Applications</b> <i>Assoc. Prof. Dr. Nirandorn Matan</i>	6
IV	<b>Wood Plastic Composite and Their Innovation</b> <i>Mr. Thanawatth Sattabongkot</i>	7
V	<b>Innovation of Rubber Wood Technology</b> <i>Prof. Dr. Paridah Md.Tahir</i>	8
VI	<b>Overview of Natural Rubber Research in Prince of Songkla University</b> <i>Assoc. Prof. Dr. Charoen Nakason</i>	9
VII	<b>Overview of Natural Rubber Application in Thailand</b> <i>Mr. Boonharn Ou-Udomying</i>	10
VIII	<b>Epoxidized Natural Rubber Production and Application in China</b> <i>Prof. Yu Heping</i>	
IX	<b>Understanding of the dynamic structure of unvulcanized NR : an essential step to address its quality variability</b> <i>Dr. Laurent Vaysse</i>	11
X	<b>Jump over from the scientific research to commercialization through developing innovative natural rubber product for new applications</b> <i>Assist. Prof. Dr. Ekwipoo Kalkornsraprane</i>	12



## Understanding of the dynamic structure of unvulcanized NR: an essential step to address its quality variability

Laurent VAYSSE

*CIRAD, UMR IATE, France*

**ABSTRACT:** The first part of this presentation is a visit of the different structural levels of raw natural rubber. The second aims to show that those structures are continuously changing along the way that transforms the latex exuding from the tree to the raw natural rubber material that is introduced in the mixers of the end-used product manufacturer.

### Structural levels of Natural Rubber

Three structural study scales could be proposed to describe raw Natural Rubber (NR). The **biochemical composition** concerns the chemical structure of the poly(*cis*-1,4-isoprene) macro--molecules, but also the composition of non-isoprene constituents (lipids, proteins, etc.). The **mesostructure** includes the macromolecular structure (Mw, Mn, molar masses distribution or MMD) and the aggregates formed by the association of poly(*cis*-1,4-isoprene) molecules (gel). The **bulk properties** deal with the materials as a whole, and is characterized by physical properties measurements. Some analytical techniques that are available to assess those structural levels will be presented, together with several examples of results.

### Dynamic of structuration of Natural Rubber: a long structuring story from the initial producer (i.e. the tree) to the end-used product manufacturer

Object size-based approach such as the three different structural levels described previously is a good descriptive tool of the NR material at a certain time and is very helpful to develop a common understanding. Nevertheless, this description is valid only at a precise stage of life of the NR before it ends in the mixer of the end-user such as the tire manufacturer. The second part of this presentation aims to show how the structure of rubber is permanently evolving not only from the release of latex by rubber tree to the dry state but also in the period of storage lasting from the production of the NR bale in the "remiller" factory to the time of its use in the end-used product manufacturer. Several examples will be provided (effect of tree age, effect of coagulation, effect of maturation, effect of process including drying, effect of storage.)

**Natural Rubber Innovation Expo 2018**  
**03-05/05/2018, Surat Thani**

**Understanding of the dynamic structure of unvulcanized NR :  
an essential step to address its quality variability**

Dr. Laurent VAYSSE  
CIRAD, UMR IATE, France

**Abstract**

The first part of this presentation is a visit of the different structural levels of raw natural rubber. The second aims to show that those structures are continuously changing along the way that transforms the latex exuding from the tree to the raw natural rubber material that is introduced in the mixers of the end-used product manufacturer.

**Structural levels of Natural Rubber**

Three structural study scales could be proposed to describe raw Natural Rubber (NR). The **biochemical composition** concerns the chemical structure of the poly(*cis*-1,4-isoprene) macro--molecules, but also the composition of non-isoprene constituents (lipids, proteins, etc.) [1,2,3]. The **mesostructure** includes the macromolecular structure ( $M_w$ ,  $M_n$ , molar masses distribution or MMD, ...) and the aggregates formed by the association of poly(*cis*-1,4-isoprene) molecules (gel) [4,6]. The **bulk properties** deal with the materials as a whole, and is characterized by physical properties measurements [5].

Some analytical techniques that are available to assess those structural levels will be presented, together with several examples of results.

**Dynamic of structuration of Natural Rubber : a long structuring story from the initial producer (i.e. the tree) to the end-used product manufacturer**

Object size-based approach such as the three different structural levels described previously is a good descriptive tool of the NR material at a certain time and is very helpful to develop a common understanding. Nevertheless, this description is valid only at a precise stage of life of the NR before it ends in the mixer of the end-user such as the tire manufacturer. The second part of this presentation aims to show how the structure of rubber is permanently evolving not only from the release of latex by rubber tree to the dry state but also in the period of storage lasting from the production of the NR bale in the "remiller" factory to the time of its use in the end-used product manufacturer. Several examples will be provided (effect of tree age [7], effect of coagulation [8], effect of maturation [9,10], effect of process including drying[11] , effect of storage [12,13], ...)



## Bibliography

- [1] Vaysse L, Bonfils F, Sainte Beuve J, Cartault M. Natural Rubber. In: Polymer Science: A Comprehensive Reference. Amsterdam: Elsevier BV; 2012. p. 281-91.
- [2] Liengprayoon S, Sriroth K, Dubreucq E, Vaysse L. Glycolipid composition of Hevea brasiliensis latex. Phytochem. 2011;**72**:1902-13.
- [3] Liengprayoon S, Chaiyut J, Sriroth K, Bonfils F, Sainte-Beuve J, Dubreucq E, Vaysse L. Lipid compositions of latex and sheet rubber from Hevea brasiliensis depend on clonal origin. Eur J Lipid Sci Technol. 2013;**115**:1021-31.
- [4] Kim C, Morel M, Sainte Beuve J, Collet A, Guilbert S, Bonfils F. Characterization of natural rubber using size-exclusion chromatography with online multi-angle light scattering : Study of the phenomenon behind the abnormal elution profile. J Chromato A. 2008;**1213**:181-8.
- [5] Kim C, Morel M, Sainte Beuve J, Guilbert S, Bonfils F. Better Characterization of Raw Natural Rubber by Decreasing the Rotor Speed of Mooney Viscometer: Role of Macromolecular Structure. Polym Eng Sci. 2010;**50**:240-8.
- [6] Dubascoux S, Thepchalerm C, Dubreucq E, Wisunthorn S, Vaysse L, Kiatkamjornwong S, Nakason C, Bonfils F. Comparative study of the mesostructure of natural and synthetic polyisoprene by size exclusion chromatography-multi-angle light scattering and asymmetrical flow field flow fractionation-multi-angle light scattering. J Chromato A. 2012;**1224**:27-34.
- [7] Bonfils F, Doumbia A, Char C, Sainte Beuve J. Evolution in the Natural Rubber Native Structure and Plasticity Retention Index from the First Tapping of Clonal Trees. J Appl Polym Sci. 2005;**97**:903-9.
- [8] De Oliveira Reis G, Menut P, Bonfils F, Vaysse L, Sanchez C. Rheological properties of colloidal gels from Hevea brasiliensis latex. International Soft Matter Conference. Poster. 15-19 Sept 2013, Rome, Italy 2013.
- [9] Intapun J, Sainte Beuve J, Bonfils F, Tanrattanakul V, Dubreucq E, Vaysse L. Characterization of natural rubber cup coagula maturation conditions and consequences on dry rubber properties. J Rubb Res. 2009;**12**:171-84.
- [10] Intapun J, Sainte Beuve J, Bonfils F, Tanrattanakul V, Dubreucq E, Vaysse L. Effect of micro-organisms during initial coagula maturation of Hevea natural rubber. J Appl Polym Sci. 2010;**118**:1341-8.
- [11] Sainte Beuve J, Sylla S, Laigneau J. Effect of soluble Non-rubber Elements and Preliminary on Water-rubber Balances. J Rubb Res. 2000;**3**:14-24.
- [12] Wisunthorn S, Vaysse L, Liengprayoon S, Sainte Beuve J, Bonfils F. Study by SEC-MALS of the dynamic structuring of natural rubber: importance of the genotype. J Appl Polym Sci. 2012;**24**:1570-7.
- [13] Thepchalerm C, Wisunthorn S, Vaysse L, Kiatkamjornwong S, Nakason C, Bonfils F. Mesostructure Evolution during Storage of Rubber Films from Washed Cream Latex and Skim Latex. Advanced Materials Research. 2014;**844**:417-20.

***All the presented data are issued from multi-lateral cooperation dedicated to NR materials notably numerous studies conducted in the framework of Hevea Rubber Platform in Partnership (HRPP) based in Bangkok, Thailand, and PlantLipPolGreen based in Montpellier, France and PlantLipPolGreen Asia based in Bangkok, Thailand.***

### **All contributors to the present work are gratefully thanked:**

Jérôme Sainte-Beuve(CIRAD), Frédéric Bonfils (CIRAD), Céline Bottier (CIRAD), Christine Char-Raluy (CIRAD), Karim Chelbi (CIRAD), Maxime Geniez (CIRAD), Suwaluk Wisinthorn (PSU), Charoen Nakason (PSU), Jutharat Intapun (PSU), Varaporn Tanrattanakul (PSU), Siriluck Liengprayoon (KAPI, KU), Natedao Musigamart (KAPI, KU), Kittipong Rattanaporn (KAPI, KU), Klanarong Sriroth (KAPI, KU), Jatuporn Chaiyut (KAPI, KU), Eric Dubreucq (Montpellier Supagro), Maeva Subileau (Montpellier Supagro), Paul Menut (Montpellier Supagro), Christian Sanchez (Univ Montpellier), André Collet (Univ Montpellier), Francois-Xavier Sauvage (INRA), Chandi Kim (Cambodia Rubber Research Center), Suda Kiatkamjornwong (Chulalongkorn University), Yacine Hemar (University of Auckland), Kantida Wadeesirisak (KU), Chalao Thepchalerm (PSU SupAgro), Sophie Bellacicco (SupAgro), Mélanie Salomez (SupAgro), Sebastien Rollere (UM2), Guilherme De Oliveira Reis (CNPq brazil, UM2).